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Revision

# 产 品 规 格 书

## Product Specification

产品名  
Product TFT-LCD Module机种名  
Model LM215DT5A

【接收印栏】

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※ 本基准书由封面、附件等全 20 页构成。

如果对该规格书有异议, 请在下单前提出。

※ This Product Specification have 20 pages including the coversheet and Appendices. Please negotiate the objection point before purchase order.

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MODEL NO: LM215DT5A

[illegible]

## 1. GENERAL DESCRIPTION

### 1.1 OVERVIEW

This module is color active matrix LCD module incorporating amorphous silicon TFT(Thin Film Transistor) LCD panel. It is composed of a color TFT-LCD panel, driver ICs, LED Backlight...etc. Graphics and texts can be displayed on a 1920×RGB×1080 dots panel with about 16.7M colors (R/G/B 6bits+Hi FRC data in each color) by using LVDS(Low Voltage Differential Signaling) to interface, +5V of DC supply voltage.

### 1.2 CHARACTERISTICS

| CHARACTERISTICS ITEMS                              | SPECIFICATIONS            |
|--|---------------------------|
| Screen Diagonal [in]                               | 21.5"                     |
| Pixels [lines]                                     | 1920×1080                 |
| Active Area [mm]                                   | 476.64 (H) x 268.11 (V)   |
| Pixel Pitch [mm]                                   | 0.24825 (H) x 0.24825 (V) |
| Pixel Arrangement                                  | RGB vertical stripe       |
| Display Mode                                       | Normally White            |
| Surface treatment<br>(Without the protection film) | Anti-glare,3H             |

### 1.3 MECHANICAL SPECIFICATIONS

| Item        |                | Min.  | Typ.  | Max.  | Unit | Remark   |
|-------------|----------------|-------|-------|-------|------|----------|
| Module Size | Horizontal (H) | 495.1 | 495.6 | 496.1 | mm   | [Note 1] |
|             | Vertical (V)   | 291.7 | 292.2 | 292.7 | mm   | [Note 1] |
|             | Depth (D)      | 9.8   | 10.3  | 10.8  | mm   | [Note 1] |
| Weight      |                |       | 1780  |       | g    |          |

[Note 1] Please refer to the attached drawings for more information of front and back outline dimensions and the dimension of bosses are not included.

## 2. ABSOLUTE MAXIMUM RATINGS

### 2.1 ABSOLUTE RATINGS OF ENVIRONMENT

| Item                          | Symbol          | Value |      | Unit | Note         |
|-------------------------------|-----------------|-------|------|------|--------------|
|                               |                 | Min.  | Max. |      |              |
| Storage Temperature           | T <sub>ST</sub> | -20   | +60  | °C   | [Note 1,3]   |
| Operating Ambient Temperature | T <sub>OP</sub> | 0     | 50   | °C   | [Note 1,2,3] |

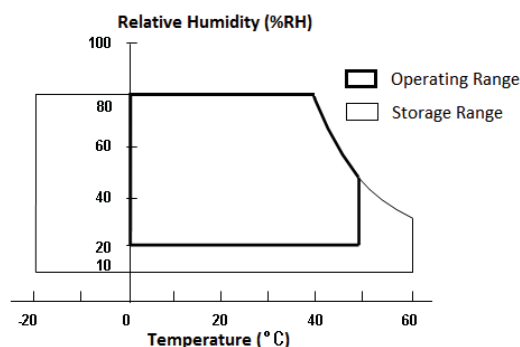
Storage Condition: With shipping package.

Shelf life: one year

[Note 1] Temperature and relative humidity range is shown in the figure below.

\*1) 80 %RH Max. ( $T_a \leq 40$  °C).

\*2) Wet-bulb temperature should be 40 °C Max. ( $T_a > 40$  °C).



\*3) No condensation.

[Note 2] The maximum operating temperature is based on the test condition that the surface temperature of display area is less than or equal to 50°C with LCD module alone in a temperature controlled chamber. Thermal management should be considered in your product design to prevent the surface temperature of display area from being over 60°C. The range of operating temperature may degrade in case of improper thermal management in your product design.

[Note 3] The rating of environment is base on LCD module. Leave LCD cell alone, this environment condition can't be guaranteed. Except LCD cell, the customer has to consider the ability of other parts of LCD module and LCD module process.

### 3. ELECTRICAL CHARACTERISTICS

#### 3.1 ABSOLUTE MAXIMUM RATING

| Parameter             | Symbol | Condition | Ratings   | Unit | Remark |
|-----------------------|--------|-----------|-----------|------|--------|
| +5V supply voltage    | VCC    | Ta=25°C   | 0 ~ +6    | V    |        |
| Storage temperature   | Tstg   | -         | -20 ~ +60 | °C   |        |
| Operation temperature | Topa   | -         | 0 ~ +50   | °C   |        |

#### 3.2 CONTROL CIRCUIT DRIVING

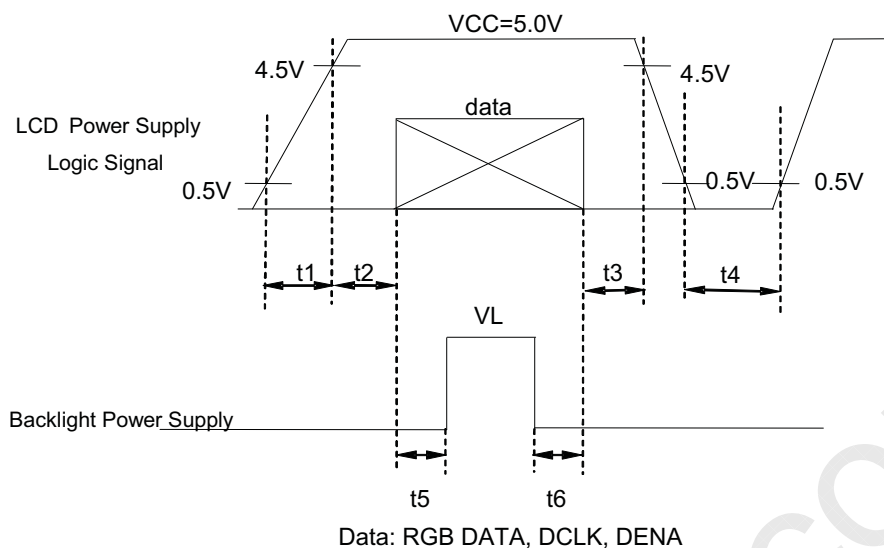
| Parameter                              |                     | Symbol | Min  | Typ | Max | Unit  | Remark                         |
|--|---------------------|--------|------|-----|-----|-------|--------------------------------|
| +5V supply voltage                     | Supply voltage      | VCC    | 4.5  | 5.0 | 5.5 | V     | [Note 1]                       |
|  | Current dissipation | ICC    | —    | 820 | 900 | mA    | VCC=5.0V,60Hz<br>Black Pattern |
|  |                     | IRush  | —    | —   | 3   | A     | [Note 2]                       |
| Permissible input ripple voltage       |                     | VRP    | —    | —   | 300 | mVp-p | VCC=5.0V                       |
| Differential Input Threshold Voltage   | High                | VTH    | —    | —   | 100 | mV    | VCM=1.2V<br>[Note 3]           |
|  | Low                 | VTL    | -100 | —   | —   | mV    |                                |
| Input Differential Voltage             |                     | VID    | 100  | —   | 600 | mV    |                                |
| Differential Input Common Mode Voltage |                     | VCM    | 1.0  | 1.2 | 1.5 | V     |                                |
| Power consumption                      |                     | P      | —    | 4.1 | 4.5 | W     |                                |

[VCM]: Common mode voltage of LVDS driver.

[Note1]

Power, data sequence

|   |                         |
|---|-------------------------|
| $0.50\text{ms} \leq t_1 \leq 10\text{ms}$ | $t_4 \geq 1\text{ sec}$ |
| $0.01\text{ms} < t_2 \leq 50\text{ms}$    | $t_5 \geq 500\text{ms}$ |
| $0.01\text{ms} < t_3 \leq 50\text{ms}$    | $t_6 \geq 200\text{ms}$ |



※ Data: CLKIN±, RIN0±, RIN1±, RIN2±, RIN3±

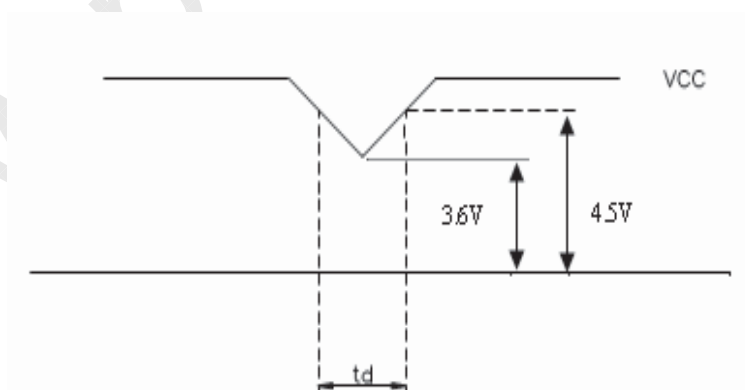
※ About the relation between data input and back light lighting, please base on the above-mentioned input sequence.

※ When back light is switched on before panel operation or after a panel operation stop, it may not display normally. But this phenomenon is not based on change of an incoming signal, and does not give damage to a liquid crystal display.

※ VCC-dip conditions:

(1) When  $3.6V \leq VCC(\min) < 4.5V$ ,  $t_d \leq 10\text{ ms}$

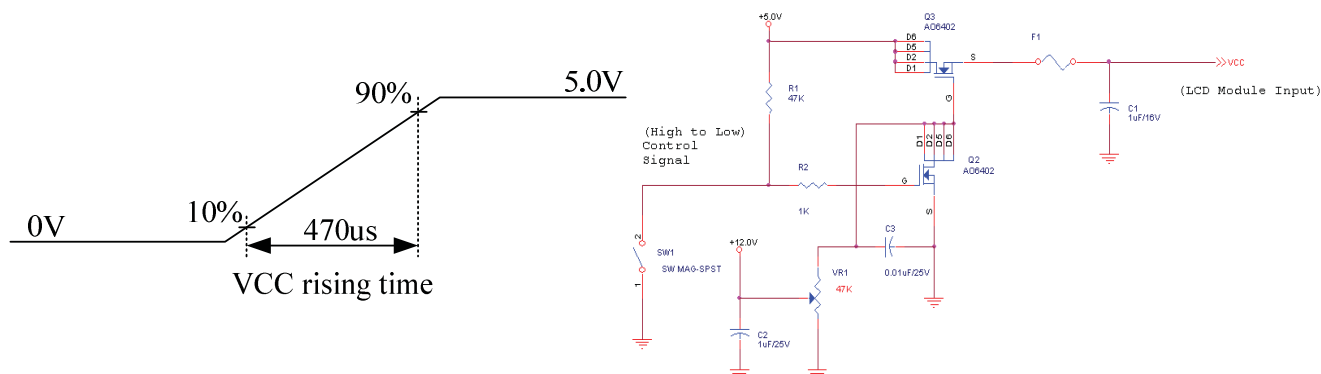
(2) When  $VCC < 3.6V$ , VCC-dip conditions should also follow the VCC-turn-on conditions.



[Note2]

IRush Measurement Condition:

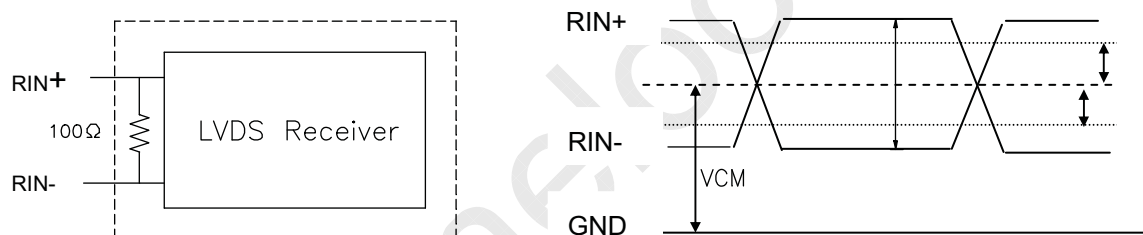
The duration of rising time of power input is 470us.



[Note3]

RIN+: Positive differential DATA &amp; CLK Input

RIN -: Negative differential DATA &amp; CLK Input



### 3.3 LED LIGHTBAR SPECIFICATION FOR BACKLIGHT

| Parameter                           | Symbol    | Value  |      |       | Unit | Note                    |
|-------------------------------------|-----------|--------|------|-------|------|-------------------------|
|                                     |           | Min.   | Typ. | Max.  |      |                         |
| Input Voltage                       | $V_{pin}$ | 43.5   | 49.5 | 54    | VDC  | Duty 100%<br>[Note 1,3] |
| LED Light bar Current per input pin | $I_{pin}$ | -      | 60   | -     | mADC | Duty 100%<br>[Note 1,3] |
| LED Life Time                       | LT        | 30,000 | -    | -     | Hrs  | [Note 2]                |
| Power Consumption                   | PBL       | 10.44  | -    | 12.96 | W    |                         |
| Dimming Duty Ratio                  | -         | 20     | -    | 100   | %    |                         |

[Note 1] Permanent damage to the device may occur if maximum values are exceeded. Function operation should be restricted to the conditions described under Normal Operating Conditions.

[Note 2] The life time of LED is defined as the time when it continues to operate under the condition at  $T_a = 25 \pm 2^\circ\text{C}$  and  $I_{pin} = 60 \text{ mA}$  until the brightness becomes  $\leq 50\%$  of its original value.

[Note3] The backlight unit contains 1pcs lightbar.

## 4. INTERFACE PIN CONNECTION

### 4.1 TFT LCD MODULE

CN1 (Interface signals and +5V DC power supply) Shown on the next table.

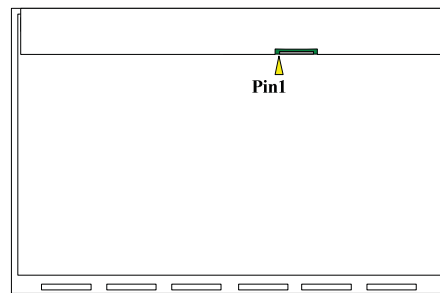
Using connector: FI-XB30SSRLA-HF-16(JAE) or compatible

Matching connector: FI-X30HL(JAE) or compatible

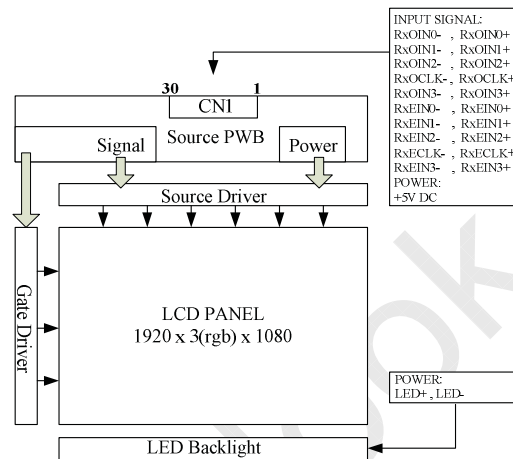
| Pin No. | Symbol  | Function                        | Remark |
|---------|---------|---------------------------------|--------|
| 1       | RxOIN0- | Negative LVDS DATA input(ODD)   | LVDS   |
| 2       | RxOIN0+ | Positive LVDS DATA input(ODD)   | LVDS   |
| 3       | RxOIN1- | Negative LVDS DATA input(ODD)   | LVDS   |
| 4       | RxOIN1+ | Positive LVDS DATA input(ODD)   | LVDS   |
| 5       | RxOIN2- | Negative LVDS DATA input(ODD)   | LVDS   |
| 6       | RxOIN2+ | Positive LVDS DATA input(ODD)   | LVDS   |
| 7       | GND     | Ground                          |        |
| 8       | RxOCLK- | Negative LVDS Clock input(ODD)  | LVDS   |
| 9       | RxOCLK+ | Positive LVDS Clock input(ODD)  | LVDS   |
| 10      | RxOIN3- | Negative LVDS DATA input(ODD)   | LVDS   |
| 11      | RxOIN3+ | Positive LVDS DATA input(ODD)   | LVDS   |
| 12      | RxEIN0- | Negative LVDS DATA input(EVEN)  | LVDS   |
| 13      | RxEIN0+ | Positive LVDS DATA input(EVEN)  | LVDS   |
| 14      | GND     | Ground                          |        |
| 15      | RxEIN1- | Negative LVDS DATA input(EVEN)  | LVDS   |
| 16      | RxEIN1+ | Positive LVDS DATA input(EVEN)  | LVDS   |
| 17      | GND     | Ground                          |        |
| 18      | RxEIN2- | Negative LVDS DATA input(EVEN)  | LVDS   |
| 19      | RxEIN2+ | Positive LVDS DATA input(EVEN)  | LVDS   |
| 20      | RxCLK-  | Negative LVDS Clock input(EVEN) | LVDS   |
| 21      | RxCLK+  | Positive LVDS Clock input(EVEN) | LVDS   |
| 22      | RxEIN3- | Negative LVDS DATA input(EVEN)  | LVDS   |
| 23      | RxEIN3+ | Positive LVDS DATA input(EVEN)  | LVDS   |
| 24      | GND     | Ground                          |        |
| 25      | NC      | No connection(Do not connect)   |        |
| 26      | NC      | No connection(Do not connect)   |        |
| 27      | NC      | No connection(Do not connect)   |        |
| 28      | VDD     | POWER +5V                       |        |
| 29      | VDD     | POWER +5V                       |        |
| 30      | VDD     | POWER +5V                       |        |



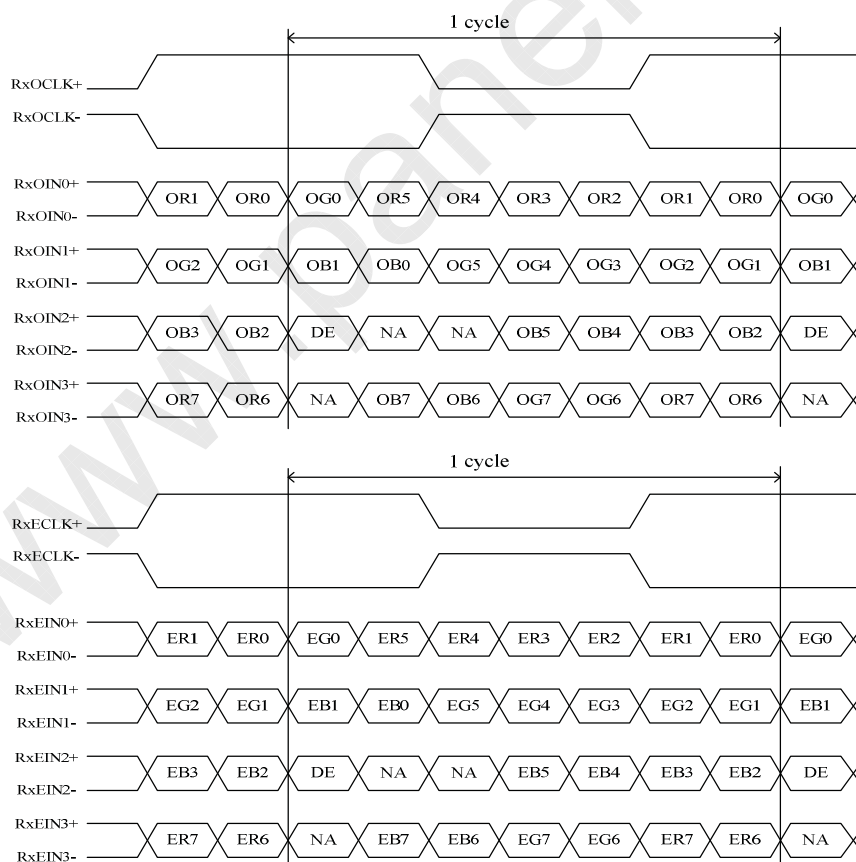
[Note 1] Pin1 start from left side.



## 4.2 BLOCK DIAGRAM



## 4.3 LVDS INTERFACE



DE: Display Enable

NA: Not Available (Fixed Low)

R/G/B Data 7: MSB, R/G/B Data 0:LSB, O : "First Pixel Data" E : "Second Pixel Data"

## 4.4 COLOR DATA INPUT ASSIGNMENT

|                     | Colors &<br>Gray scale | Data signal   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |   |  |  |
|---------------------|------------------------|---------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|---|--|--|
|                     |                        | Gray<br>Scale | R0 | R1 | R2 | R3 | R4 | R5 | R6 | R7 | G0 | G1 | G2 | G3 | G4 | G5 | G6 | G7 | B0 | B1 | B2 | B3 | B4 | B5 | B6 | B7 |   |  |  |
|                     |                        |               |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |   |  |  |
| Basic Color         | Black                  | —             | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |   |  |  |
|                     | Blue                   | —             | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |   |  |  |
|                     | Green                  | —             | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |   |  |  |
|                     | Cyan                   | —             | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |   |  |  |
|                     | Red                    | —             | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |   |  |  |
|                     | Magenta                | —             | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |   |  |  |
|                     | Yellow                 | —             | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |   |  |  |
|                     | White                  | —             | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |   |  |  |
| Gray Scale of Red   | Black                  | GS0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |   |  |  |
|                     | ↑                      | GS1           | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |   |  |  |
|                     | Darker                 | GS2           | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |   |  |  |
|                     | ↑                      | ↓             | ↓  |    |    |    |    |    |    | ↓  |    |    |    |    |    |    | ↓  |    |    |    |    |    |    | ↓  |    |    |   |  |  |
|                     | ↓                      | ↓             | ↓  |    |    |    |    |    |    | ↓  |    |    |    |    |    |    | ↓  |    |    |    |    |    |    | ↓  |    |    |   |  |  |
|                     | Brighter               | GS253         | 1  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0 |  |  |
|                     | ↓                      | GS254         | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0 |  |  |
|                     | Red                    | GS255         | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0 |  |  |
| Gray Scale of Green | Black                  | GS0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |   |  |  |
|                     | ↑                      | GS1           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |   |  |  |
|                     | Darker                 | GS2           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |   |  |  |
|                     | ↑                      | ↓             | ↓  |    |    |    |    |    |    | ↓  |    |    |    |    |    |    | ↓  |    |    |    |    |    |    | ↓  |    |    |   |  |  |
|                     | ↓                      | ↓             | ↓  |    |    |    |    |    |    | ↓  |    |    |    |    |    |    | ↓  |    |    |    |    |    |    | ↓  |    |    |   |  |  |
|                     | Brighter               | GS253         | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0 |  |  |
|                     | ↓                      | GS254         | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0 |  |  |
|                     | Green                  | GS255         | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0 |  |  |
| Gray Scale of Blue  | Black                  | GS0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |   |  |  |
|                     | ↑                      | GS1           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |   |  |  |
|                     | Darker                 | GS2           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  |   |  |  |
|                     | ↑                      | ↓             | ↓  |    |    |    |    |    |    | ↓  |    |    |    |    |    |    | ↓  |    |    |    |    |    |    | ↓  |    |    |   |  |  |
|                     | ↓                      | ↓             | ↓  |    |    |    |    |    |    | ↓  |    |    |    |    |    |    | ↓  |    |    |    |    |    |    | ↓  |    |    |   |  |  |
|                     | Brighter               | GS253         | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1 |  |  |
|                     | ↓                      | GS254         | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |   |  |  |
|                     | Blue                   | GS255         | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1 |  |  |

0: Low level voltage,

1: High level voltage.

Each basic color can be displayed in 256 gray scales from 8 bit data signals. According to the combination of total 24 bit data signals, the 16,7M colors display can be achieved on the screen.

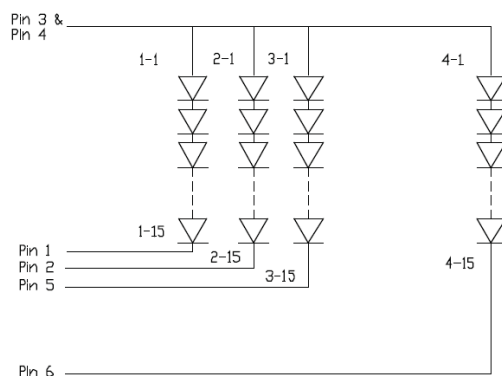
#### 4.5 BACKLIGHT INTERFACE CONNECTION

LED light bar connector type : CI1406M1HRB-NH, manufactured by CVILUX.

| Pin No. | Signal name        |
|---------|--------------------|
| 1       | ILED (current out) |
| 2       | ILED (current out) |
| 3       | VLED (voltage in)  |
| 4       | VLED (voltage in)  |
| 5       | ILED (current out) |
| 6       | ILED (current out) |

#### 4.6 BACKLIGHT UNIT

The backlight unit contains one lightbar.



Electrical Circuit of lightbar

## 5. INTERFACE TIMING

### 5.1 INPUT SIGNAL TIMING SPECIFICATIONS

(a) The input signal timing specifications are shown as the following table and timing diagram.

| Item       |      |            | Symbol                    | Min  | Typ.  | Max.  | Unit  |      |
|------------|------|------------|---------------------------|------|-------|-------|-------|------|
| LCD Timing | DCLK |            | Freq.                     | fCLK | 55    | 72    | 90    | MHz  |
|            |      |            | Cycle                     | tCLK | 18.18 | 13.89 | 11.11 | ns   |
|            | DE   | Horizontal | Horizontal effective time | tHA  | 960   | 960   | 960   | tCLK |
|            |      |            | Horizontal blank time     | tHB  | 32    | 100   | 115   | tCLK |
|            |      |            | Horizontal total time     | tH   | 992   | 1060  | 1075  | tCLK |
|            |      | Vertical   | Vertical frame Rate       | Fr   | 50    | 60    | 75    | Hz   |
|            |      |            | Vertical total time       | tV   | 1084  | 1130  | 1170  | tH   |
|            |      |            | Vertical effective time   | tVA  | 1080  | 1080  | 1080  | tH   |
|            |      |            | Vertical blank time       | tVB  | 4     | 50    | 90    | tH   |

[Note]

\*1) DE (data enable) usually is positive.

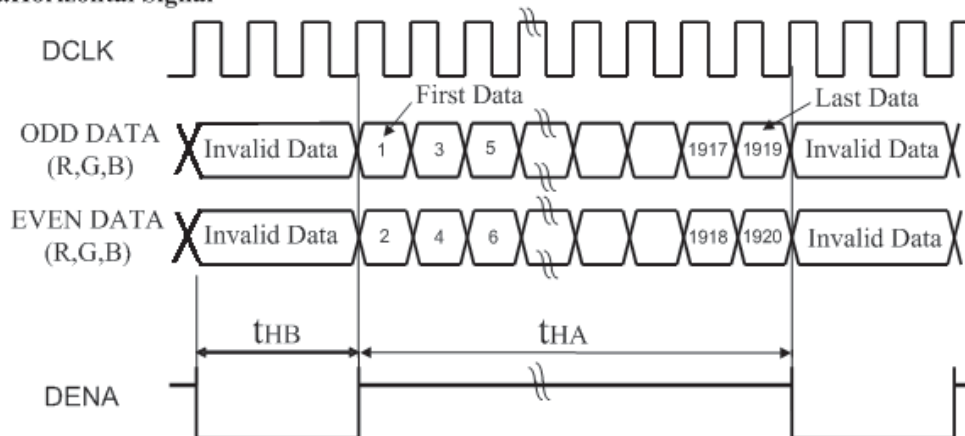
\*2) DCLK still inputs during blanking.

\*3) DE mode only.

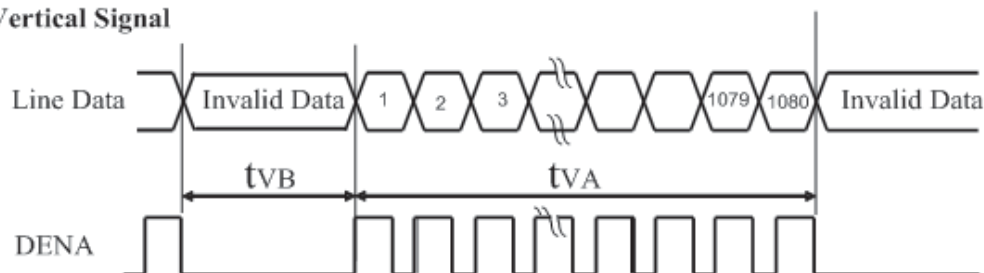
\*4) It maybe cause flicker at 50Hz.

(b) Timing Chart

#### a.Horizontal Signal



#### b.Vertical Signal



## 6. OPTICAL CHARACTERISTICS

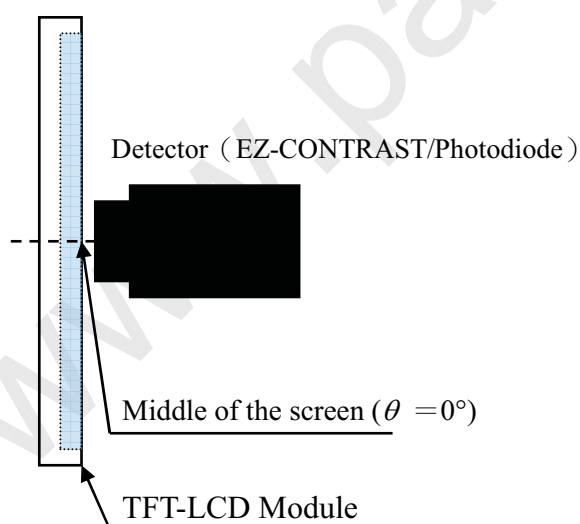
### 6.1 OPTICAL SPECIFICATION

Ta=25°C

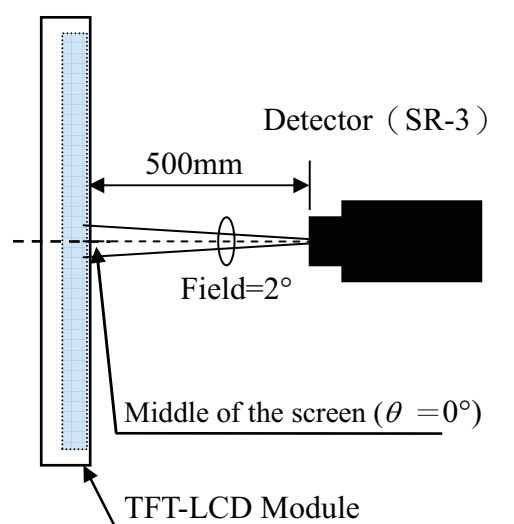
| Parameter             |            | Symbol                  | Condition         | Min.  | Typ.     | Max. | Unit              | Remark             |
|-----------------------|------------|-------------------------|-------------------|-------|----------|------|-------------------|--------------------|
| Luminance             |            | L                       | $\theta = 0$ deg. | 160   | 200      |      | cd/m <sup>2</sup> | [Note 1,4]         |
| Luminance uniformity  |            | $\Delta L$              | $\theta = 0$ deg. | 75    |          |      | %                 | [Note 1,5]         |
| Contrast ratio        |            | CR                      | $\theta = 0$ deg. | 400   | 600      | -    | -                 | [Note2,4]          |
| Response time         |            | Tr+Tf                   |                   | -     | 5        | 8    | ms                | Tr+Tf<br>[Note3,4] |
| Chromaticity of white | x          | Typ-0.03                |                   | 0.313 | Typ+0.03 | -    | [Note 4]          |                    |
|                       | y          | Typ-0.03                |                   | 0.329 | Typ+0.03 | -    |                   |                    |
| Chromaticity of red   | x          | Typ-0.03                |                   | 0.645 | Typ+0.03 | -    |                   |                    |
|                       | y          | Typ-0.03                |                   | 0.348 | Typ+0.03 | -    |                   |                    |
| Chromaticity of green | x          | Typ-0.03                |                   | 0.327 | Typ+0.03 | -    |                   |                    |
|                       | y          | Typ-0.03                |                   | 0.624 | Typ+0.03 | -    |                   |                    |
| Chromaticity of blue  | x          | Typ-0.03                |                   | 0.150 | Typ+0.03 | -    |                   |                    |
|                       | y          | Typ-0.03                |                   | 0.061 | Typ+0.03 | -    |                   |                    |
| Viewing angle range   | Horizontal | $\theta 21 + \theta 22$ | CR $\geq 10$      | 85-   | 90       | -    | Deg.              | [Note1,4]          |
|                       | Vertical   | $\theta 11 + \theta 12$ |                   | 55-   | 65       | -    | Deg.              |                    |

\*The measurement shall be executed 30 minutes after lighting at rating.

\* The optical characteristics are measured using the following equipment.

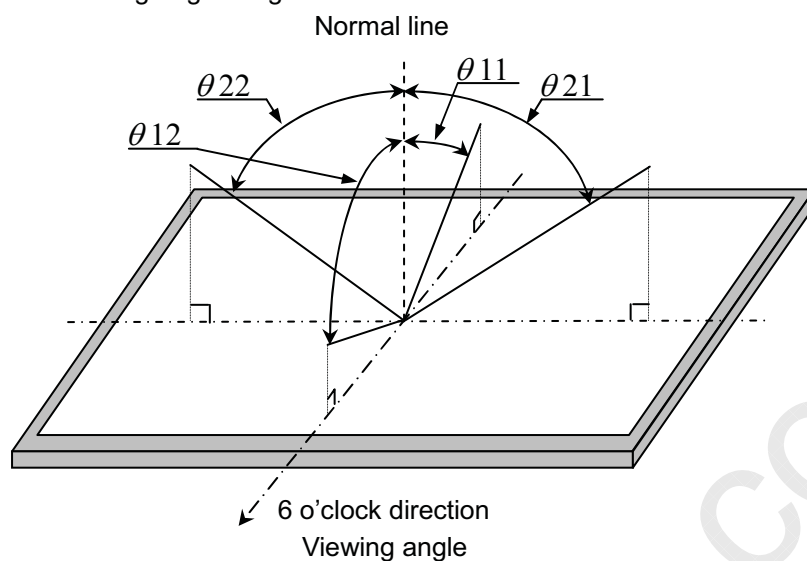


Measurement of viewing angle range, Response time.



Measurement of Contrast, Luminance, Chromaticity.

[Note 1] Definitions of viewing angle range:



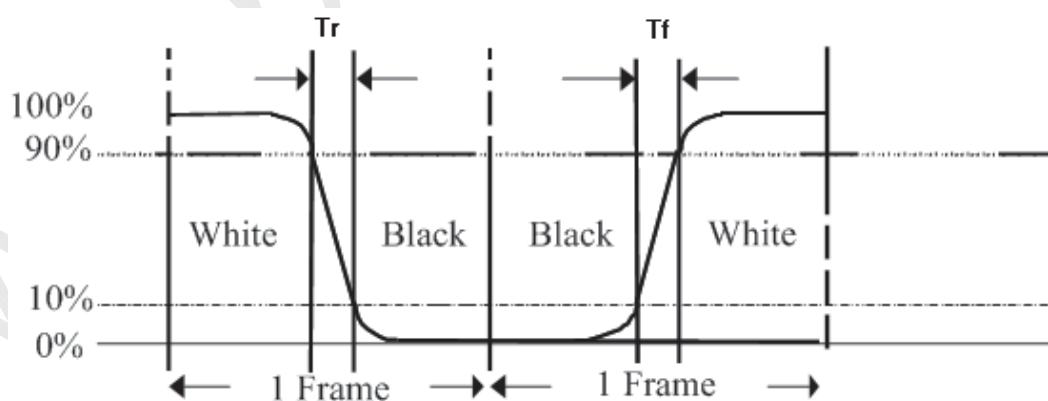
[Note 2] Definition of contrast ratio:

The contrast ratio is defined as the following.

$$\text{Contrast Ratio} = \frac{\text{Luminance (Brightness) with white screen}}{\text{Luminance (Brightness) with black screen}}$$

[Note 3] Definition of response time

The output signals of photo detector are measured when the input signals are changed from “Full White” to “Full Black” (rising time, TR), and from “Full Black” to “Full Black” (falling time, TF), respectively. The response time is interval between the 10% and 90% (1 frame at 60 Hz) of amplitudes.



$$\text{Response time} = \text{Tr} + \text{Tf}$$

[Note 4] This shall be measured at center of the screen.

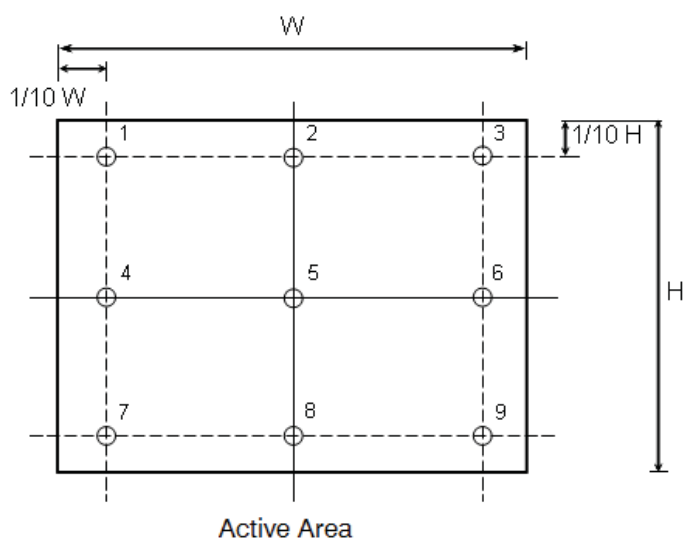
[Note 5] Definition of Luminance and Luminance uniformity :

Luminance : To measure at the center position “5” on the screen (NO.5).

Luminance uniformity : Lw (MAX) and Lw(MIN) are the maximum and minimum luminance value

measure at the position “1~9” on the screen (NO.1~9) and the equation :

$$\Delta Lw = Lw(\text{MIN}) / Lw(\text{MAX}) \times 100\%$$



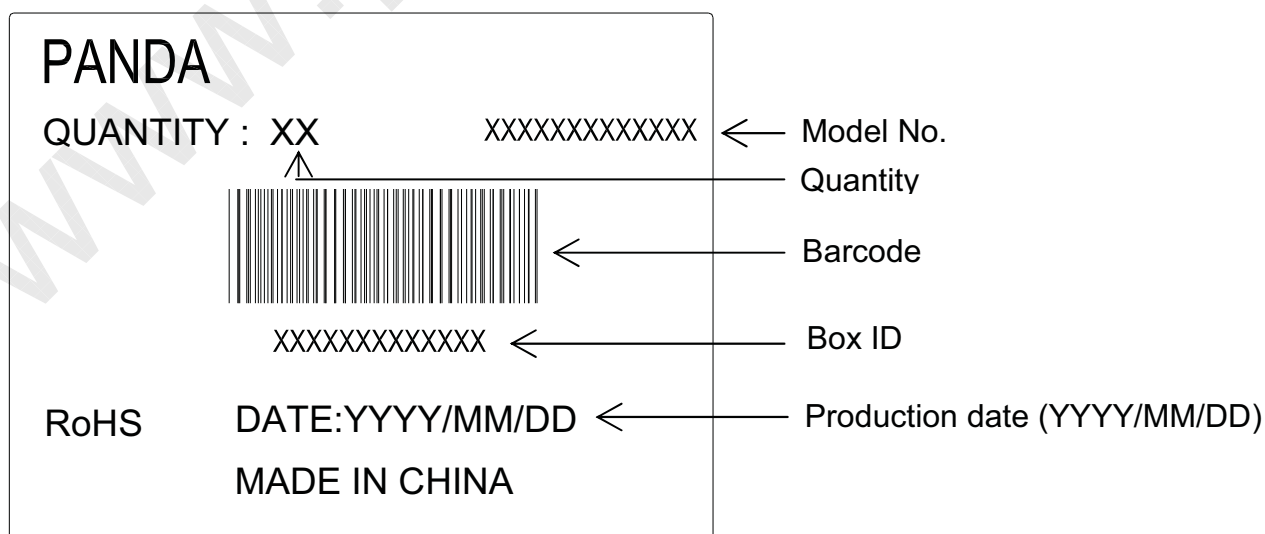
## 7. DEFINITION OF LABELS

### 7.1 MODULE LABEL

The label of displays, product model (LM215DT5A), and product label is stuck on the back side of the Module.



### 7.2 PACKING LABEL



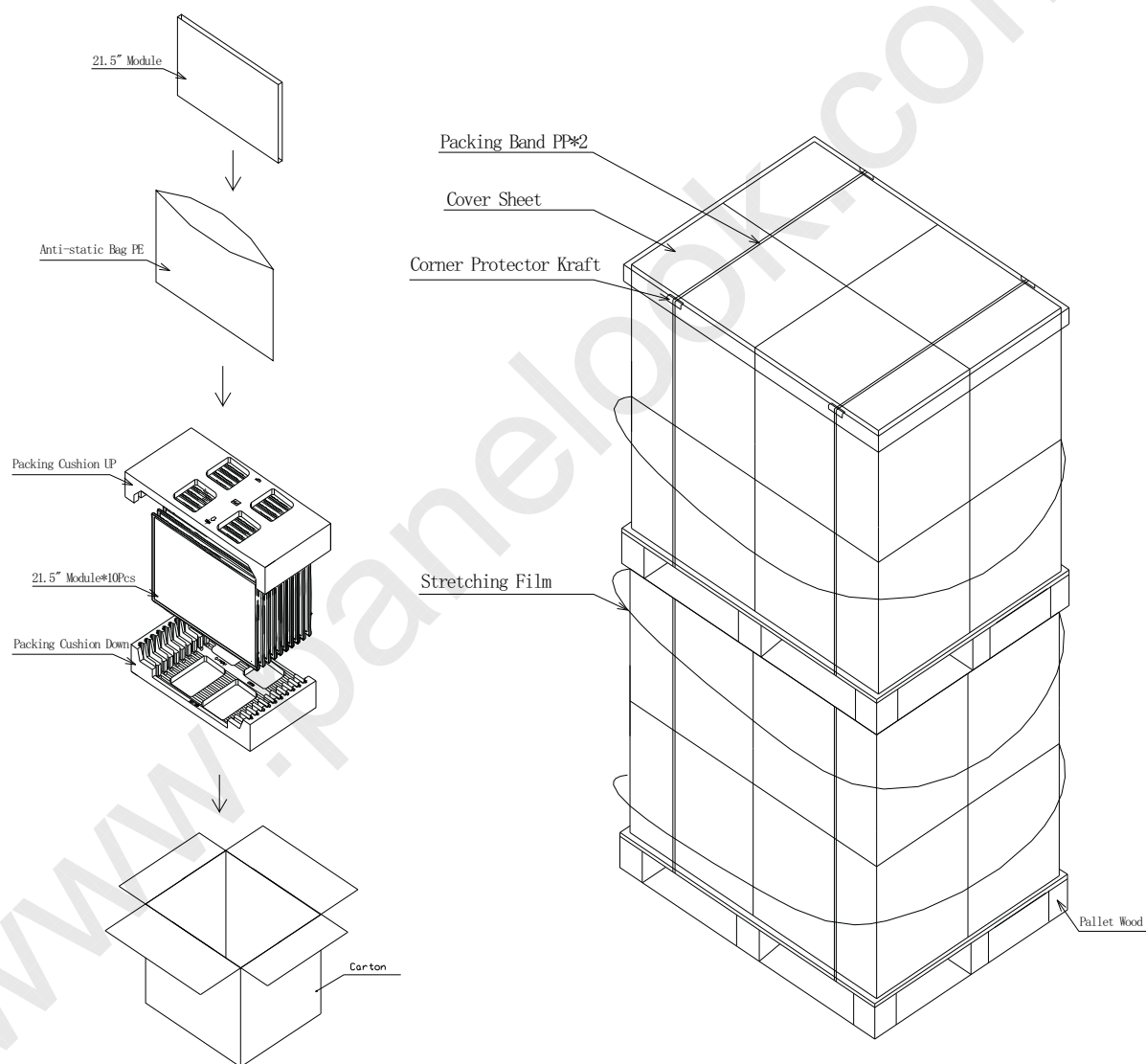


## 8. PACKING

### 8.1 PACKING SPECIFICATIONS

|  |                          |
|--|--------------------------|
| PIILING NUMBER OF CARTON                         | 8                        |
| Packing quantity in one carton                   | 10 pcs                   |
| Carton size                                      | 569(L)x455(W)x387(H) mm  |
| Pallet size                                      | 1200(L)x950(W)x150(H) mm |
| Total mass of one carton filled with full module | 19.8 kg                  |

### 8.2 PACKING METHOD







## 9. CARTON STORAGE CONDITION

Temperature: 0°C to 40°C

Humidity: 80%RH or less

Reference condition: 20°C to 35°C, 80%RH or less (summer)

5°C to 15°C, 80%RH or less (winter)

The total storage time (40°C, 80%RH): 240h or less

Sunlight Be sure to shelter a product from the direct sunlight.

Atmosphere Harmful gas, such as acid and alkali which bites electronic components and/or wires must not be detected.

Be sure to put cartons on palette or base, don't put it on floor, and store them with removing from wall.

Please take care of ventilation in storehouse and around cartons, and control changing temperature is within limits of natural environment.

## 10. PRECAUTIONS

### 10.1 ASSEMBLY AND HANDLING PRECAUTIONS

- (a) Do not apply rough force such as bending or twisting to the module during assembly.
- (b) It is recommended to assemble or to install a module into the user's system in clean working areas.  
The dust and oil may cause electrical short or worsen the polarizer.
- (c) Since the LCM consists of TFT and electronic circuits with CMOS-ICs, which are very weak to electrostatic discharge, person who is handling an LCM should be grounded though adequate methods such as an anti-static wrist band. Connector pins should not be touched directly with bare hands.

Reference: Process control standard is shown as follow,

|   | item   | Management standard value and performance standard           |
|---|--|--|
| 1 | Anti-static mat(shelf)                             | 1to50 [Mega ohm]   |
| 2 | Anti-static mat(floor, desk)                       | 1to100 [Mega ohm]  |
| 3 | Ionizer  | Attenuate from $\pm 1000V$ to $\pm 100V$ within two seconds. |
| 4 | Anti-static wrist band                             | 0.8 to 10 [Mega ohm]   |
| 5 | Anti-static wrist band entry and ground resistance | Below 1000 [ohm]   |
| 6 | Temperature  | 22 to 26 [°C]  |
| 7 | Humidity   | 60 to 70 [%]   |

- (d) Do not apply pressure or impulse to the module to prevent the damage of LCD panel and backlight.
- (e) Always follow the correct power-on sequence when the LCD module is turned on. This can prevent the damage and latch-up of the CMOS LSI chips.
- (f) Be sure to turn off the power supply when inserting or disconnecting the cable.
- (g) Do not disassemble the module.
- (h) Front polarizer can easily be damaged, so please pay attention on it.
- (i) Using a absorbent cotton or other soft cloth without chemicals for cleaning, because the surface of polarizer is very soft and easily scratched.
- (j) Since long contact with drops of water may cause discoloration or spots, please wipe off them as soon as possible.



- (k) The Panel will be broken or chipped when it is dropped or bumped against a hard substance.
- (l) Applying too much force and stress to PWB and drivers may cause a malfunction electrically and mechanically.
- (m) Please be careful since image retention may occur when a fixed pattern is displayed for a long time.
- (n) Moisture can easily penetrate into LCD module and may cause the damage during operation.
- (o) High temperature or humidity may deteriorate the performance of LCD module. Please store LCD modules in the specified storage conditions.
- (p) This LCM is corresponded to RoHS.
- (q) When any question or issue occurs, it shall be solved by mutual discussion.

## 10.2 SAFETY PRECAUTIONS

- (a) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.
- (b) After the module's end of life, it is not harmful in case of normal operation and storage.

## 11. Reliability test items

### (a) Environment test condition(LCM)

| Test item                                       | Condition                                 |
|---|---|
| High temperature storage test                   | Ta= 60°C, 240h                            |
| Low temperature storage test                    | Ta=-20°C, 240h                            |
| High temperature and high humidity storage test | Ta=50°C, 80%RH, 240h<br>(No condensation) |
| High temperature operation test                 | Ta= 50°C, 240h                            |
| Low temperature operation test                  | Ta= 0°C, 240h                             |
| Thermal Shock Test                              | -20°C/30min, 60°C/30min, 100 cycles       |
| On/Off Test                                     | On/10sec, Off/10sec, 30,000 cycles        |

### (b) Shock & Vibration(LCM)

| Test item                    | Condition   |
|------------------------------|---|
| Shock<br>(Non-Operation)     | Shock level: 50 Grms<br>Waveform: half sine wave, 20ms<br>Direction: $\pm X, \pm Y, \pm Z$<br>One time each direction |
| Vibration<br>(Non-Operation) | Wave form: Random<br>Vibration level: 1.5 Grms<br>Bandwidth: 10-200 Hz<br>Duration: X,Y,Z each direction per 30 min   |

[Result evaluation criteria]

Under the display quality test condition with normal operation state, there shall be no change, which may affect practical display function.

## 12. Mechanical Drawing

